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## Do canola cultivars differ in sulphur fertilizer requirements for optimum yield, seed quality and S uptake?

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### BACKGROUND

- On marginally S-deficient soils, combinations of high N rates with more frequent production of high S using and high yielding crops and cultivars with increased cropping intensity result in faster depletion of S from soil.
- Because of high S requirements, canola is more prone to S deficiency than cereals.
- In recent years, many canola producers in the Parkland region have experienced substantial losses in seed yield, apparently due to severe S deficiency at flowering and pod formation stages.
- Crop yield response to S fertilization on S-deficient soils depends on soil type, with significant increase on coarse textured soils but not on medium textured soils.
- Response of different cultivars for the *Brassica species* to S fertilization in controlled condition and some field studies has not been conclusive.
- As *B. napus* and *B. rapa* canola cultivars grown in the Parkland region differ in their growth rate, yield potential, rooting system, and genetics, there may be a potential to use high S utilization efficiency canola cultivars to optimize yield and seed quality benefits from fertilization of S-deficient soils.
- But, there is limited field research information on the relative response of canola cultivars to S fertilization in this region.

### OBJECTIVE

- The objective of this study was to compare the relative response of selected canola cultivars to S fertilization in S-deficient soils, so as to optimize seed yield and quality benefits and to consider different S fertilizer recommendations for the various cultivars.

### MATERIALS AND METHODS

- A three site-years field study was conducted on S-deficient Gray Luvisol (Boralfs) soils in northeastern Saskatchewan (Table 1).
- There were sixteen treatments in a factorial combination of four S rates (0, 5, 10 and 15 kg S ha<sup>-1</sup>, as K<sub>2</sub>SO<sub>4</sub>) with four cultivars (Quantum and AC Excel – *Brassica napus* L; Maverick and Parkland – *B. rapa* L.).
- A randomized complete block design (RCBD) was used to arrange plots in four replications.

- Each plot received a blanket application of 120 kg N, 30 kg P and 20 kg K ha<sup>-1</sup>.
- All fertilizers were broadcast on soil surface and incorporated into the soil.
- A double-disc press drill was used to seed canola at 17.8 cm row spacing and 9 kg ha<sup>-1</sup> seed rate.
- Data were recorded on yield, total S concentration, S uptake in seed and straw, and protein and oil concentration in seed.

## RESULTS

- For yield of seed and straw and S uptake of seed, both the actual values and response to S fertilization was relatively greater for the two *B. napus* cultivars compared to the two *B. rapa* cultivars.
- The differences between the *B. napus* and *B. rapa* cultivars tended to increase with increase in S rate.
- But the response of seed quality measurements and S uptake in straw to S fertilization was not influenced by the cultivars, although there were differences between actual values for the cultivars.
- For all four cultivars, however, generally yield responded up to the 10 kg S ha<sup>-1</sup> rate, and seed quality and S uptake measurements responded up to 15 kg S ha<sup>-1</sup> rate.
- Response to S fertilization was generally of quadratic nature for seed and straw yield, oil and protein concentration in seed, and S uptake in seed, while the nature of response for S concentration in seed and S uptake in straw was not consistent.
- The yield, seed quality and S uptake data suggest no need for different S fertilization recommendation for each cultivar.
- In summary, the results suggest that increase in seed yield from S fertilization varies with canola cultivars, but similar fertilizer S rate for different cultivars.

## CONCLUSIONS

- Response to S fertilization was relatively greater for seed and straw yield, and S uptake in seed of both *Brassica napus* cultivars (Quantum and AC Excel) compared to both *B. rapa* cultivars (Maverick and Parkland).
- The actual seed and straw yield, and S uptake in seed were also generally higher for *B. napus* than *B. rapa* cultivars.
- Thus, the differences in seed and straw yield, and S uptake in seed between *B. napus* and *B. rapa* cultivars tended to increase with increase in S rate.
- The response of seed quality measurements (oil, protein and S concentrations), and S uptake in straw did not show a consistent influence of the cultivars, even though the actual values for the cultivars were different.
- Response to S fertilization was generally of quadratic nature for seed and straw yield, oil and protein concentration in seed, and S uptake in seed; while the nature of response for S concentration in seed and S uptake in straw was not consistent.
- Generally, all cultivars had near maximum seed and straw yield at 10 kg S ha<sup>-1</sup>, while near maximum oil, protein, and S concentrations in seed as well as the S uptake in seed and straw were observed at 15 kg S ha<sup>-1</sup>.

- Overall, seed and straw yield of *B. napus* cultivars was more responsive to S fertilization than of *B. rapa* cultivars but the data did not indicate any need for different fertilizer S rate for each cultivar.

## ACKNOWLEDGEMENTS

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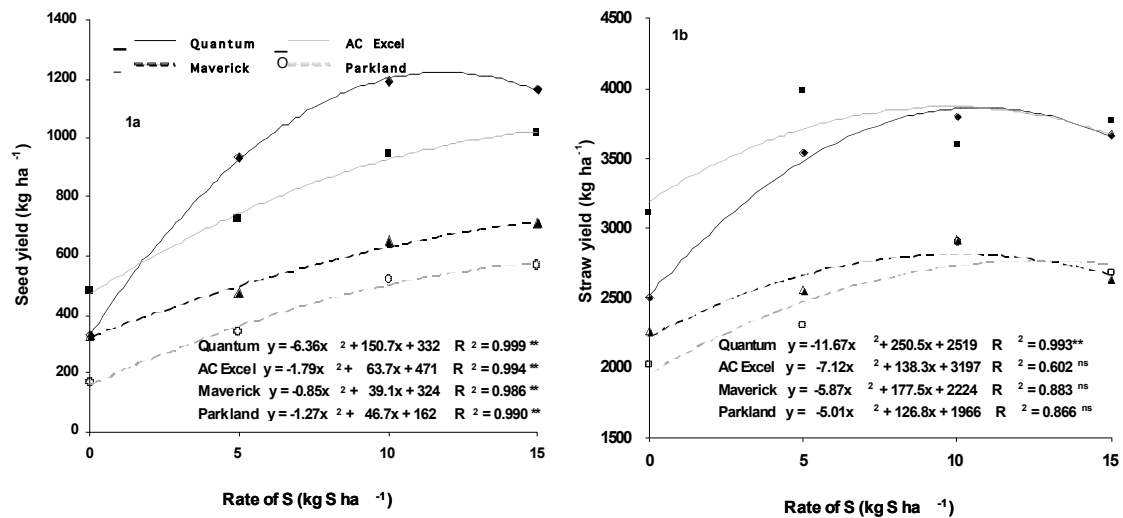


Figure 1. Seed and straw yield of four canola cultivars as a function of S rates in north-eastern Saskatchewan (mean of three site -years).

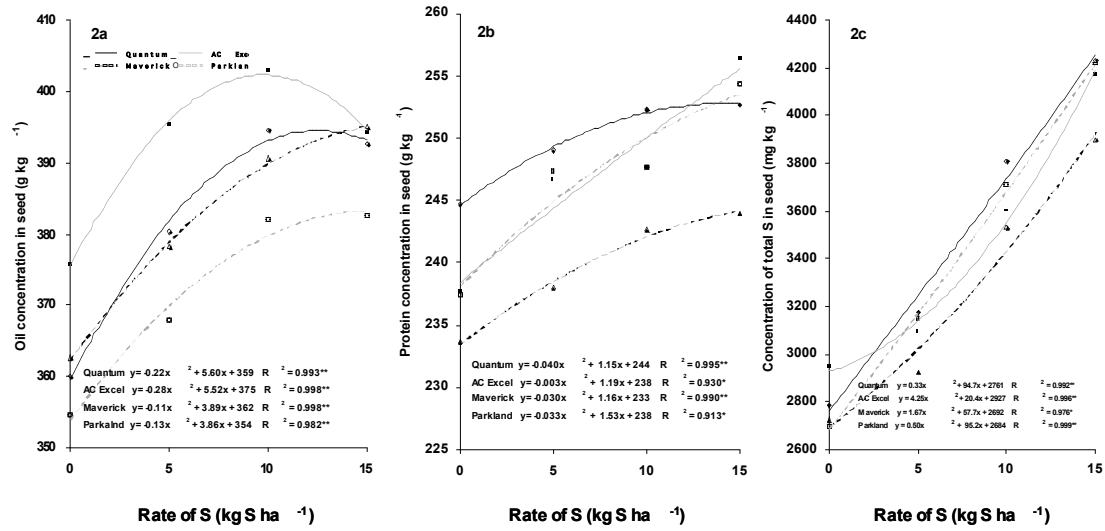


Figure 2. Oil, protein, and total S concentration in seed of four canola cultivars as a function of S rates in north-eastern Saskatchewan (mean of three site-years).

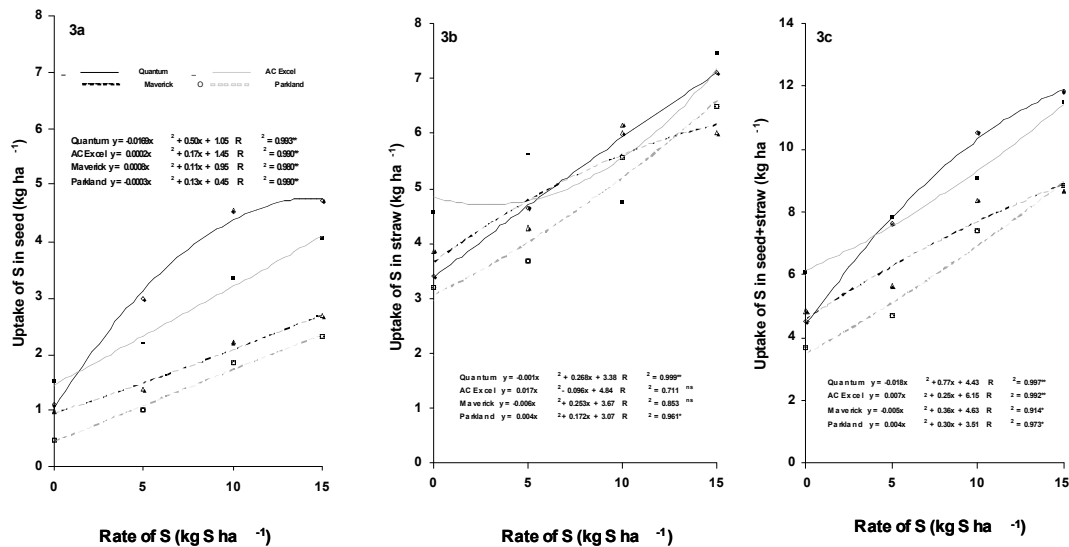


Figure 3. Uptake of S in seed, straw and seed+straw of four canola cultivars as a function of S rates in north-eastern Saskatchewan (mean of three site-years).

Table 1. Some characteristics of soils for the different site-years in north-eastern Saskatchewan

Site-year	Great Group <sup>Z</sup>	Depth (cm)	Texture	Organic matter (%)	pH (1:2 water)	SO <sub>4</sub> -S (mg kg <sup>-1</sup> )	NO <sub>3</sub> -N (mg kg <sup>-1</sup> )
Tisdale 1999	Gray Luvisol	0-15	Sandy loam	4.6	6.6	10.0	6.4
		15-30			6.9	9.0	5.0
		30-60			8.1	8.4	11.0
Tisdale 2000	Gray Luvisol	0-15	Sandy loam	4.6	6.7	9.4	20.0
		15-30			7.4	4.8	4.2
		30-60			8.1	5.0	2.6
Archerwill 2000	Gray Luvisol	0-15	Sandy loam	5.4	7.4	8.2	14.2
		15-30			7.6	7.4	8.0

<sup>Z</sup> Based on Canadian Soil Classification System.